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THE NESTING HABITS OF ANTHIDIUM.¹

AXEL LEONARD MELANDER.

The care and forethought which an insect shows in providing for an offspring which in most cases she will never see have always excited the interest of biologists. Among these insects the solitary bees have especially attracted the attention of observers on account of their varied habits of nest construction. Here, in a group of insects more or less homogeneous, we find the style of architecture under such differing forms as the fence-rail excavations of the carpenter-bees, the thimble-like nest of the leaf-cutters, or the *Andrena*-burrows in wayside paths.

The genus *Anthidium* affords no less interesting methods of house construction. For many years the habits of a few species of this genus have been well known, but they constitute but a small contribution when the whole number of species is considered. In a recent monograph of the European species of *Anthidium* Dr. Henry Friese estimates the total number of species of the world at between five and six hundred. Already some two hundred and twenty have been described, but of these the habits of the two hundred are yet to be made known.

Anthidium is a genus of fixed morphology, that is the species rather markedly resemble one another. All have the abdomen destitute of hair above, and brightly ornate with yellowish markings. Notwithstanding this similarity in appearance the habits of the species are quite different. Two distinct methods of nest-building are presented, from one or the other of which the species, at least so far as known, scarcely ever depart. The French entomologist, Fabre, has tersely called these two categories, those of the "Cottonniers" and of the "Résiniers."

The cotton-workers do not show much deviation from the habits of other bees and might be considered to possess the primitive nesting-habit of this genus. Among bees the female either digs a hole in the ground or, more usually, occupies one already dug. Apparently all that is sought is a convenient

¹ Contributions from the Zoölogical Laboratory of the University of Texas, No. 12.

nidus; the form is of small moment. *Anthidium* has been known to choose abandoned burrows of other bees, or the excavations made by Scarabæid larvæ. There are several cases recorded where even key-holes have been utilized. In other species the nests are placed, not in the ground, but in hollow plant stems. In all these cases the nest is lined with a hard compacted cottony down scraped from the stems of pubescent plants by means of the dentate mandibles of the female.



FIG. I. Nest of *Anthidium texanum* Cress.

With the "Résiniers" the habits are to some extent different. They have the peculiar habit of constructing their nests with the aid of the resin of various conifers. In addition to this some

of the species invariably seek out the empty shells of different Helices wherein to start their future family.

Thus far, the habits of but three of the forty-one North American species of *Anthidium* have been made known. Of these *emarginatum* and *parosclæ* are "Cottonniers," and construct their nests normally in dry sand-banks. The third species, *consimile*, builds among the branches of shrubs or in crevices in rocks and has habits somewhat resembling those of the resin-worker, *texanum*, here to be described.¹

That *Anthidium* presents the two types of nest construction in both the Old and the New World shows these to be very ancient habits whose divergence occurred at an indefinitely remote period.

While collecting insects in January, on the south side of the Colorado River, a few miles west of Austin (Texas), at an altitude of about eight hundred feet, a nest of what proved to be *Anthidium texanum* was found.

This structure was fastened to a branch of cedar (*Juniperus virginianus* Linn.) about eight feet from the ground. In appearance it was like a small rounded conglomerate with a greatest diameter of twenty-three, and a least of eighteen millimeters. This curious nest consisted of small pebbles of limestone, from one to three millimeters in thickness, securely cemented together with an amber-colored resin, presumably derived from the cedars. Its weight after the bees had transformed was five grammes.

In this mass were six pupal cells. They consisted of a tough, chestnut-brown membrane, more or less transparent so that the pupæ within could be seen. They were four and one half millimeters in diameter, about ten millimeters deep, with a rounded bottom, flat top, and slightly narrowed in width above. The flat top consisted of tougher material, in large part spun in concentric rings around a whitish, conspicuous mammilla. This projection, which is characteristic of *Anthidium*, contained a central hole, and canal to the interior.

¹ In the description of *consimile*, Dr. Davidson did not state of what material the cement was composed. Since then he has informed me that the species builds at times miles from any pines, so that then, at least, other plants probably furnish the resin. Another species, which unfortunately was not identified, was found building in pine resins on San Jacinto Mt.

The arrangement of the pupæ deserves notice. Two were entirely enclosed in the resinous mass except at their mammillated end. The three adjacent were more exposed, all on the same side from the two enclosed cells, and arranged in a row parallel with that of the two, while the sixth, which contained the only male, was quite uncovered and placed on another side of the nest. This also was the last to transform. The five contiguous cells contained females. All the pupæ were oriented alike; also, the head of the pupa was nearest the mammillated end.



FIG. 2. A single pupa cell showing the mammilla.

The first bees, two in number, emerged on May 16th, and immediately crawled back into their cases head first. The next transformed on the 19th, the fourth and fifth on the 25th, while the male did not appear until June 4th. Each imago repeated the habit of the former ones, by crawling head-first into its vacated pupa-case. The adult bees seemed to have eaten the flat end of their envelope in getting out, for no traces of it could

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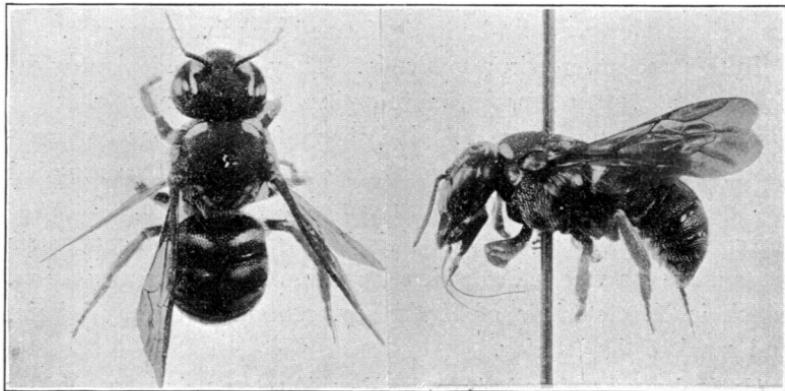


FIG. 3. *Anthidium texanum* Cress.

be found afterwards in the breeding-cage. No cottony pubescence whatever was employed in the nest-construction. The

Californian *consimile* uses granite pebbles as the basis for its nest whereas *texanum* employs limestone, there being no granite at Austin.

The adult bees are quite rare, apparently only two males having been taken previously, by Mr. G. W. Belfrage, in Bosque Co., Texas. These are the types in the collection of the American Entomological Society in Philadelphia, and have been compared with the present specimens to insure the accuracy of the specific determination. The females differ from Cresson's description of the male in having the clypeus largely black; the only yellow occurs in the extreme lateral corners. The sixth abdominal tergite is wholly black. The mandibles also are black and their apical margin is evenly truncate, whereas in the male they are apically emarginate on each side of a median tooth.

Below is appended a list of the species of *Anthidium*, the habits of which are known, and also the papers referring to these. The habits of a number of species are reviewed by Dr. H. Friese in his *Apidæ Europæ*, Vol. IV. Many interesting notes on the flowers visited by *Anthidium* are given in Knuth's *Blütenbiologie*, especially in Vol. II., pt. 2, p. 601.

"COTONNIERS."

cingulatum: Fabre, Souvenirs Entomologiques, Vol. IV.

diadema: Fabre, Souvenirs Entomologiques, Vol. IV.; Rudow, Soc. Entom., 1887-1888.

emarginatum: Davidson, Ent. News, 1895.

florentinum: Rudow, Soc. Entom., 1887-1888; Fabre, Souv. Entomol., Vol. IV.; Rudow, published by the author, Perleberg.

lituratum: Rudow, Soc. Entom., 1887-1888.

manicatum: Rudow, Soc. Entom., 1887-1888; Rudow, published by the author, Perleberg; Verhoeff, Zool. Jahrb., Syst. VI.; Fabre, Souv. Entom., IV.

montanum: Dalla Torre, Entomolog. Nachricht., 1880.

oblongatum: Rudow, Soc. Entom., III.; Xambeu, Bull. Soc. Ent. France, 1896.

paroselæ: Minnie Newberry, Psyche, 1900.

scapulare: Fabre, Souv. Entom., IV.

“RÉSINIER.”

bellicosum : Fabre, Souv. Entom., IV.

consimile : Davidson, Ent. News, 1896.

contractum : Lichtenstein-Montpellier.

latreilli : Fabre, Souv. Entom., IV.

quadrilobum : Fabre, Souv. Entom., IV.

septem-dentatum : Fabre, Souv. Entom., IV. ; Xambeu, Bull. Soc. Ent. Fr., 1896.

sticticum : Lucas, Explorat. d'Algérie, 1846 ; Tosi, Bull. Soc. Ent. Ital., XXIX.

strigatum : Friese, Apidæ Europæ, Vol. IV. ; Kirschbaum Nassanisch. Jahr., 1871.

texanum : Described above.

THE UNIVERSITY OF TEXAS,
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